Claims

I claim:

1. A catalytic cracking process for catalytically cracking a hydrocarbon feed to lighter hydrocarbon products, said process comprising the steps of:

   (a) contacting a hydrocarbon feed with hot catalytic particulates in a catalytic cracking reactor to produce an effluent comprising spent catalyst particles and lighter hydrocarbon products;

   (b) separating said spent catalyst particles from said light hydrocarbon products in a separator;

   (c) stripping said spent catalyst particles by contacting said spent catalyst particles with a stripping medium in a stripping zone;

   (d) monitoring the temperature of the spent catalyst particles in said stripping zone to determine whether the temperature exceeds a target stripping temperature ranging from about 950°F to about 1075°F;

   (e) withdrawing a portion of said spent catalyst particles from said stripping zone when the temperature of the spent catalyst particles exceeds said target stripping temperature and directing said spent catalyst particles to a catalyst cooler; and

   (f) cooling said withdrawn catalyst in said catalyst cooler and returning said cooled catalyst to said stripping zone to reduce the temperature of the catalyst in said stripping zone to a temperature below said target stripping temperature.

2. A process as defined in Claim 1 wherein said cracking reactor is selected from the group consisting of a riser reactor, a horizontal reactor and a downflow reactor.

3. A process as defined in Claim 2 wherein said cracking reactor is a riser reactor.

4. A process as defined in Claim 1 wherein said hydrocarbon feedstock is selected from the group consisting of naphtha, gas condensates, raffinate, atmospheric gas oil, vacuum gas oil, distillate, crude oil, crude resid and mixtures of any of the foregoing.

5. A process as defined in Claim 1 wherein said separator is located in an upper dilute phase zone of a disengaging vessel and said stripping zone is located in a lower dense phase zone of said disengaging vessel.

6. A process as defined in Claim 5 wherein said stripping zone is provided with baffles.

7. A process as defined in Claim 5 wherein said stripping zone is provided with packing.

8. A process as defined in Claim 5 where said catalyst cooler is located external to said disengaging vessel.

9. A process as defined in Claim 8 wherein said catalyst cooler receives hot spent catalyst from a top portion of said stripping zone, cools said hot spent catalyst in an indirect heat exchanger and returns cooled spent catalyst to a lower portion of said stripping zone.

10. A process as defined in Claim 8 wherein said catalyst cooler receives hot spent catalyst withdrawn from a lower portion of said stripping zone, adds lift gas to said withdrawn hot spent catalyst to lift said withdrawn hot spent catalyst through an indirect heat exchanger for cooling; returns said cooled spent catalyst to the upper dilute phase of said disengaging vessel; separates lift gas from said cooled spent catalyst and returns the separated cooled spent catalyst to the stripping zone.

11. A process as defined in Claim 8 wherein said catalyst cooler receives hot spent catalyst withdrawn from a lower portion of said stripping zone, adds lift gas to said withdrawn hot spent catalyst to lift said withdrawn hot spent catalyst through an indirect heat exchanger for cooling; returns said cooled spent catalyst to the stripping zone.

12. A process as defined in Claim 1 wherein said target stripping temperature ranges from about 950°F to about 1050°F.

13. A process as defined in Claim 12 wherein said target stripping temperature ranges from about 950°F to about 1025°F.

14. A process as defined in Claim 1 wherein temperature monitoring step (d) comprises placing at least one temperature sensor in the stripping zone, said temperature sensor signaling a valve control means to control the amount of catalyst being withdrawn from said stripping zone to said catalyst cooler.

15. A process as defined in Claim 1 further comprising: (g) withdrawing stripped spent catalyst from said stripping zone to a catalyst regenerator; (h) regenerating catalyst in said regenerator to produce hot regenerated catalyst; and (i) returning hot regenerated catalyst to said reactor.

16. An improved catalytic cracking process comprising a catalyst stripping zone, said improvement comprising (i) monitoring the temperature of spent catalyst particles in said stripping zone to determine whether the temperature exceeds a target stripping temperature ranging from about 950°F to about 1075°F; (ii) withdrawing a portion of said spent catalyst particles from said stripping zone when the temperature of the spent catalyst particles exceeds said target stripping temperature and directing said spent catalyst particles to a catalyst cooler; and (iii) cooling said withdrawn catalyst in said catalyst cooler and returning said cooled catalyst to said stripping zone to reduce the temperature of the catalyst in said stripping zone to a temperature below said target stripping temperature.

17. An improved process as defined in Claim 16 wherein said catalyst cooler receives hot spent catalyst from a top portion of said stripping zone, cools said hot spent catalyst in an indirect heat exchanger and returns cooled spent catalyst to a lower portion of said stripping zone.

18. An improved process as defined in Claim 16 wherein said catalyst cooler receives hot spent catalyst withdrawn from a lower portion of said stripping zone, adds lift gas to said withdrawn hot spent catalyst to lift said withdrawn hot spent catalyst through an indirect heat exchanger for cooling; returns said cooled spent catalyst to the upper dilute phase of said disengaging vessel; separates lift gas from said cooled spent catalyst and returns the separated cooled spent catalyst to the stripping zone.

19. An improved process as defined in Claim 16 wherein said catalyst cooler receives hot spent catalyst withdrawn from a lower portion of said stripping zone, adds lift gas to said withdrawn hot spent catalyst to lift said withdrawn hot spent catalyst through an indirect heat exchanger for cooling; returns said cooled spent catalyst to the stripping zone.

20. An improved process as defined in Claim 16 wherein said target stripping temperature ranges from about 950°F to about 1050°F.

21. An improved process as defined in Claim 20 wherein said target stripping temperature ranges from about 950°F to about 1025°F.

22. A process as defined in Claim 16 wherein temperature monitoring step comprises placing at least one temperature sensor in the stripping zone, said temperature sensor signaling a valve control means to control the amount of catalyst being withdrawn from said stripping zone to said catalyst cooler.

23. An apparatus for the catalytic cracking of a hydrocarbon feedstock, said apparatus comprising:

(a) a catalytic cracking reactor wherein a hydrocarbon feed is contacted with hot catalytic particulates to produce an effluent comprising spent catalyst particles and lighter hydrocarbon products;

(b) a separator for separating said spent catalyst particles from said light hydrocarbon products;

(c) a stripping zone for stripping said spent catalyst particles by contacting said spent catalyst particles with a stripping medium;

(d) a temperature sensing means for monitoring the temperature of the spent catalyst particles in said stripping zone to determine whether the temperature exceeds a target stripping temperature ranging from about 950°F to about 1075°F;

(e) a catalyst cooler for cooling a portion of said spent catalyst particles withdrawn from said stripper thereby producing a cooled spent catalyst, said catalyst cooler comprising a stripper-cooler conduit for withdrawing said portion of said spent catalyst from said stripping zone when the temperature of the spent catalyst particles exceeds said target stripping temperature; and a cooled catalyst return conduit for returning said cooled catalyst from said cooler to said stripping zone to reduce the temperature of the catalyst in said stripping zone to a temperature below said target stripping temperature.

24. An apparatus as defined in Claim 23 wherein said cracking reactor is selected from the group consisting of a riser reactor, a horizontal reactor and a downflow reactor.

25. An apparatus as defined in Claim 24 wherein said cracking reactor is a riser reactor.

26. An apparatus as defined in Claim 23 wherein said reactor is adapted to contact a hydrocarbon feedstock selected from the group consisting of naphtha, gas condensates, raffinate, atmospheric gas oil, vacuum gas oil, distillate, crude oil, crude resid and mixtures of any of the foregoing.

27. An apparatus as defined in Claim 23 wherein said separator is located in an upper dilute phase zone of a disengaging vessel and said stripping zone is located in a lower dense phase zone of said disengaging vessel.

28. An apparatus as defined in Claim 27 wherein said stripping zone is provided with baffles.

29. An apparatus as defined in Claim 27 wherein said stripping zone is provided with packing.

30. An apparatus as defined in Claim 27 where said catalyst cooler is located external to said disengaging vessel.

31. An apparatus as defined in Claim 30 wherein said catalyst cooler is adapted to receive said withdrawn hot spent catalyst from a top portion of said stripper, cool said withdrawn hot spent catalyst, and return cooled spent catalyst to a lower portion of said stripping zone.

32. An apparatus as defined in Claim 30 wherein said catalyst cooler is adapted to receive hot spent catalyst withdrawn from a lower portion of said stripping zone via a stripper-cooler conduit comprising means to add lift gas to said withdrawn hot spent catalyst in said stripper-cooler conduit to lift said withdrawn hot spent catalyst through an indirect heat exchanger for cooling, said catalyst cooler further adapted to return said cooled spent catalyst to the upper dilute phase of said disengaging vessel via a cooled catalyst return conduit comprising a separator located in said disengaging vessel that separates lift gas from said cooled spent catalyst and returns the separated cooled spent catalyst to the stripping zone.

33. An apparatus as defined in Claim 30 wherein said catalyst cooler is adapted to receive hot spent catalyst withdrawn from a lower portion of said stripping zone, add lift gas to said withdrawn hot spent catalyst to lift said withdrawn hot spent catalyst through an indirect heat exchanger for cooling, and return said cooled spent catalyst to the stripping zone.

34. An apparatus as defined in Claim 23 wherein said target stripping temperature ranges from about 950°F to about 1050°F.

35. An apparatus as defined in Claim 34 wherein said target stripping temperature ranges from about 950°F to about 1025°F.

36. A apparatus as defined in Claim 23 wherein temperature sensing means (d) comprises at least one temperature sensor located in the stripping zone, whereby said temperature sensor device signals a valve control means to control the amount of catalyst being withdrawn from said stripping zone to said catalyst cooler.

37. An apparatus as defined in Claim 23 further comprising: (h) a catalyst regenerator adapted to regenerate catalyst, produce hot regenerated catalyst and return said hot regenerated catalyst to said reactor.

38. An improved catalytic cracking apparatus comprising a catalyst stripping zone, said improvement comprising (i) a temperature sensing means for monitoring the temperature of spent catalyst particles in said stripping zone to determine whether the temperature exceeds a target stripping temperature ranging from about 950°F to about 1075°F; (ii) a catalyst cooler in flow communication with said stripping zone for cooling said spent catalyst particles; (iii) means for withdrawing a portion of said spent catalyst particles from said stripping zone when the temperature of the spent catalyst particles exceeds said target stripping temperature and directing said spent catalyst particles to said catalyst cooler; and (iv) means for returning said cooled catalyst to said stripping zone to reduce the temperature of the catalyst in said stripping zone to a temperature below said target stripping temperature.

39. An improved apparatus as defined in Claim 38 wherein said catalyst cooler is adapted to receive hot spent catalyst from a top portion of said stripping zone, cool said hot spent catalyst in an indirect heat exchanger and return cooled spent catalyst to a lower portion of said stripping zone.

40. An improved apparatus as defined in Claim 38 whereby said catalyst cooler is adapted to receive hot spent catalyst withdrawn from a lower portion of said stripping zone and whereby said means for withdrawing hot spent catalyst further comprises means to

introduce lift gas to fluidize said withdrawn spent catalyst through an indirect heat exchanger for cooling; and whereby said means for returning said cooled catalyst to said stripping zone is adapted to return said cooled spent catalyst to the upper dilute phase of said disengaging vessel, separate lift gas from said cooled spent catalyst and return the separated cooled spent catalyst to the stripping zone.

41. An improved apparatus as defined in Claim 38 whereby said catalyst cooler is adapted to receive hot spent catalyst withdrawn from a lower portion of said stripping zone and whereby said means for withdrawing hot spent catalyst further comprises means to introduce lift gas to fluidize said withdrawn spent catalyst through an indirect heat exchanger for cooling; and whereby said means for returning said cooled catalyst to said stripping zone is adapted to return said cooled spent catalyst to the stripping zone.

42. An improved apparatus as defined in Claim 38 wherein said target stripping temperature ranges from about 950°F to about 1050°F.

43. An improved apparatus as defined in Claim 42 wherein said target stripping temperature ranges from about 950°F to about 1025°F.

44. An apparatus as defined in Claim 38 wherein temperature sensing means comprises at least one temperature sensor located in the stripping zone, whereby said temperature sensing means signals a valve control means to control the amount of catalyst being withdrawn from said stripping zone to said catalyst cooler.

45. A catalytic cracking process for catalytically cracking a hydrocarbon feed to lighter hydrocarbon products, said process comprising the steps of:

(a) contacting a hydrocarbon feed in a reaction zone with hot catalytic particulates in a catalytic cracking reactor to produce an effluent comprising spent catalyst particles and lighter hydrocarbon products;

(b) discharging said effluent from a reactor outlet into a dense bed;

(c) controlling the reactor outlet temperature to a temperature above about 1075°F by controlling the amount of said hot particulate catalyst contacting said feed in said reaction zone.

(d) stripping said spent catalyst particles in a stripping zone in a lower portion of said dense bed by contacting said spent catalyst particles with a stripping medium;

(e) monitoring the temperature of the spent catalyst particles in said stripping zone to determine whether the temperature exceeds a target stripping temperature ranging from about 950°F to about 1075°F;

(f) withdrawing a portion of said spent catalyst particles from said stripping zone when the temperature of the spent catalyst particles exceeds said target stripping temperature and directing said withdrawn spent catalyst particles to a catalyst cooler; and

(g) cooling said withdrawn catalyst in said catalyst cooler and returning said cooled catalyst to said stripping zone to reduce the temperature of the catalyst in said stripping zone to a temperature below said target stripping temperature.